

PHYSICS ANALYSIS UPDATES

Elizabeth Worcester

LI Local Meeting

September 28, 2016

Physics Coordination



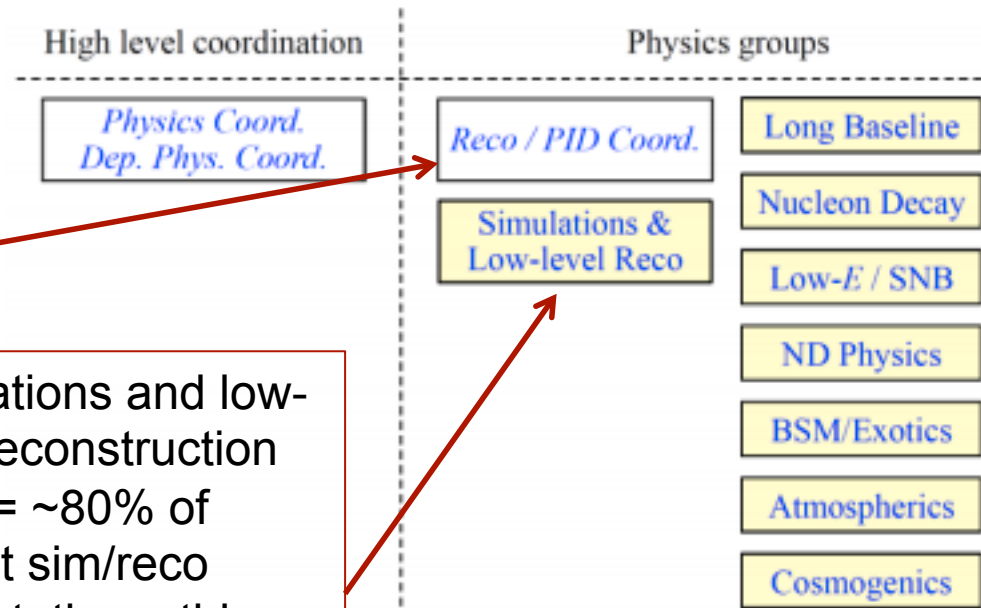
- Physics coordinator: Ryan Patterson
- Deputy physics coordinator: ETW
- New LBPWG conveners: Matt Bass, Mayly Sanchez (significant help from ETW during transition)
- A primary goal for TDR preparation: better integrate simulation, reconstruction, event selection into physics analysis groups – these are really physics tasks and not software tasks
- Ryan made a reorganization proposal to the spokespeople which is being discussed with the software/computing coordinators today; Ryan and I will have meeting with spokespeople tomorrow

Proposed Change to Physics Org Chart

- Sim/reco currently resides in software and computing
- Goal: better integrate simulation, reconstruction, event selection into physics analysis groups – these are really physics analyses

High-level analysis (eg: event selection) takes place within appropriate working groups; coordinator makes sure this happens, looks for synergy or duplication of effort

Simulations and low-level reconstruction tasks = ~80% of current sim/reco presentations: this group basically just moves from software/computing to physics



Proposed changes to standard plots



- Following up on the discussion at the collaboration meeting, we want to generate a new “standard” set of long-baseline sensitivity plots for public presentations
 - Move to single (optimized) beam design
 - Updated timeline, encourage people to show sensitivity as function of years rather than kt-MW-years
 - Additional options to illustrate DUNE’s “single-experiment” advantage
- Additionally, it would be good to have mutually agreed-upon comparisons with NOvA, T2K, T2K-II, HyperK (?)

Which beam?



- General agreement that we want to show only an optimized beam – no longer include CDR reference beam
- At last Thursday's Beam Interface/Optimization/Simulation meeting, I asked Laura to raise the question of which beam to show:
 - General agreement that it would be best to switch to a flux from a semi-engineered, semi-realistic optimized design; this is not currently available but expected to be available in a few months
- For today I made sample plots using the CDR optimized beam. We'll set a goal of having final new plots before the January collaboration meeting which can then be shown at winter conferences...the semi-realistic optimized flux should be available by then.

What other variable to consider?



- The sensitivities depend on a number of other parameters – we've always plotted a band varying the most important/uncertain parameter.
- My opinion: we should continue to have a band – a plot with just a single line looks kind of ridiculous when there are so many variables to consider – so we have to decide what is right parameter to vary.
- Options include:
 - θ_{23} central value: sensitivity is quite sensitive to this parameter; what range of values to use (NuFit 3σ probably too broad)?; this is not something we get to choose – it has a value, we just aren't sure what it is yet.
 - Systematic uncertainties: sensitivity quite sensitive to ν_e normalization uncertainty; what range of values to use?; is this something we really want to highlight in our highest level plots?
 - External constraints on oscillation parameters: not terribly sensitive to external constraints as the DUNE measurement will ultimately be best or close-to-best; this ability is something we'd like to highlight

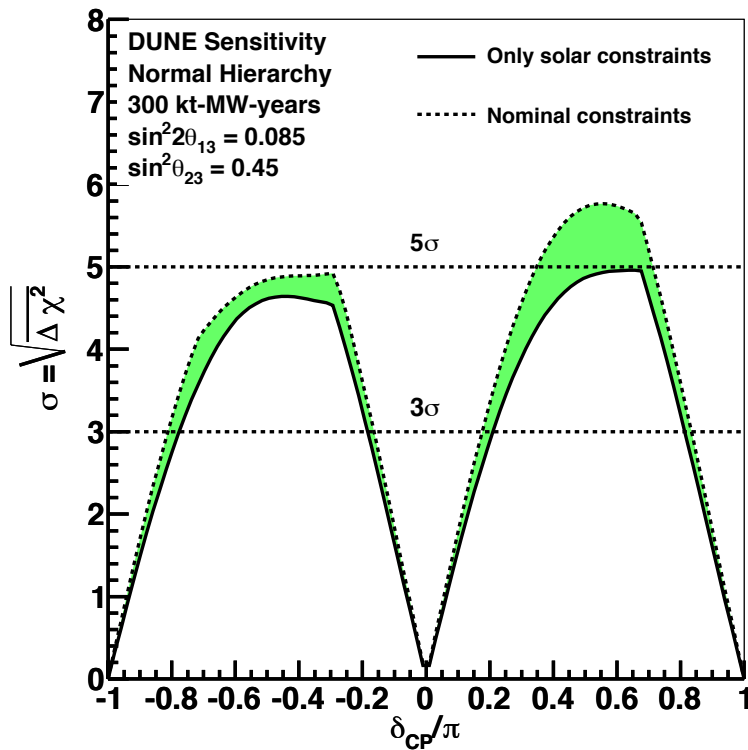
What should be standard exposures?



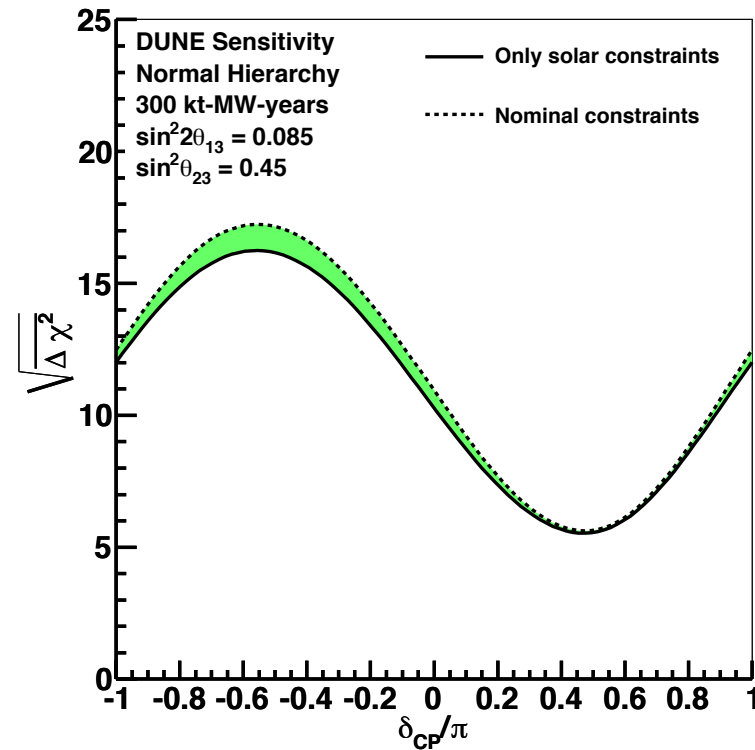
- Current nominal exposures are 300 kt-MW-years and 890 kt-MW-years
- 300 kt-MW-years corresponds to $3.5+3.5 = 7$ years at 1.07 MW, 40 kt
 - Coincidentally also corresponds to ~ 7 real years in new staging scenario
- 890 kt-MW-years is the exposure at which we achieve 3σ CPV sensitivity for 75% of δ_{CP} values for the CDR optimized beam
 - Chosen for political reasons for the CDR but it's kind of an awkward exposure to quote; perhaps the need for this is behind us
- Suggest exposures corresponding to real time in the nominal staging scenario: 7 years, 10 years, 15 years

Sample Plots: External Constraints

CP Violation Sensitivity



Mass Hierarchy Sensitivity

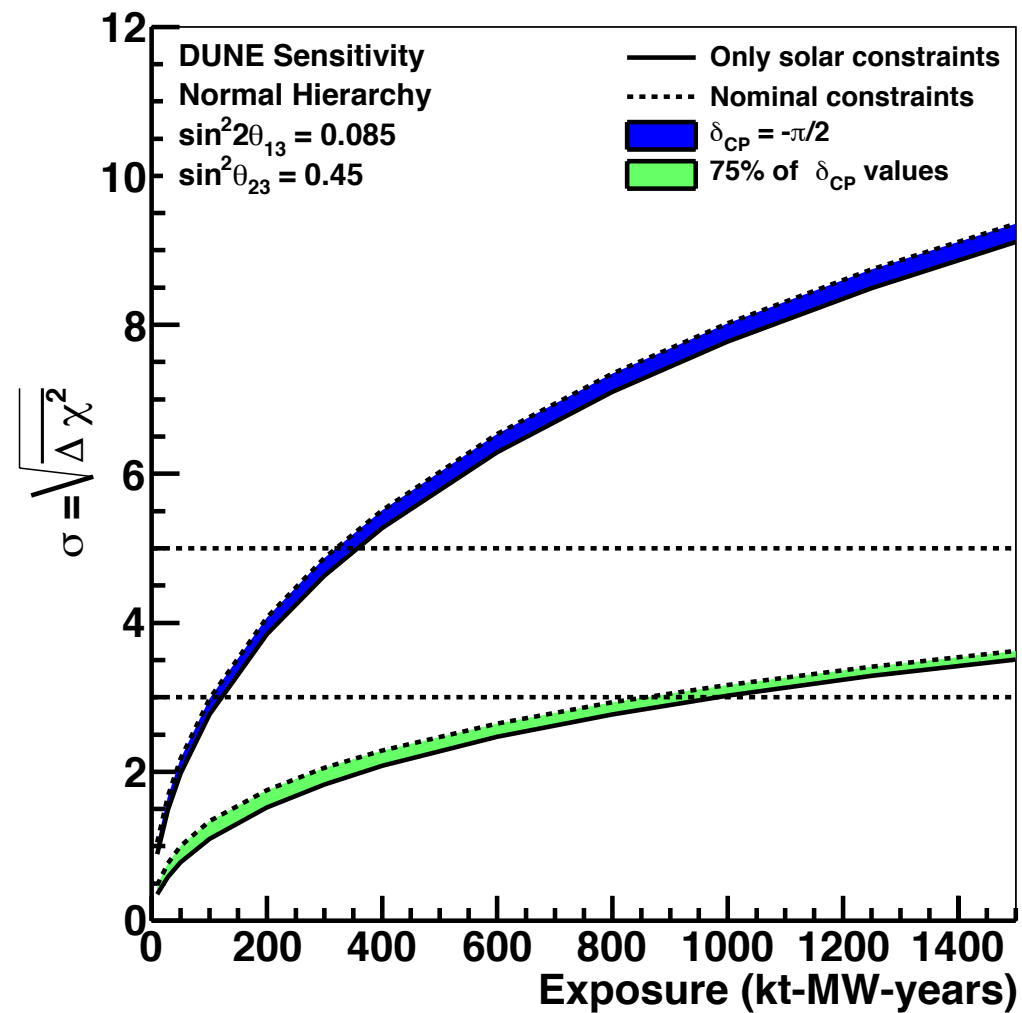


About exposure plots



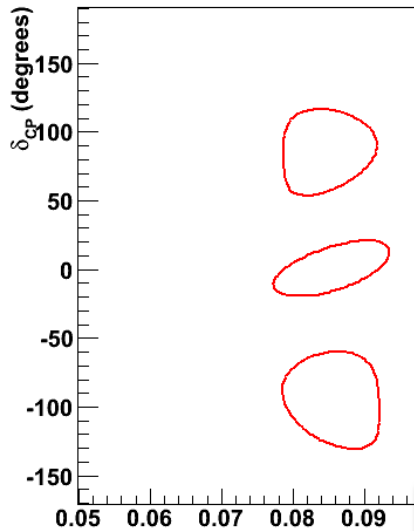
- CDR exposure (both in kt-MW-years and real years) plotted minimum sensitivity for 50% or 75% δ_{CP} coverage
 - Is it confusing to have both metrics floating around?
 - In light of recent results, is this still the most interesting metric?
 - Should we also show a plot at $\delta_{CP} = -\pi/2$?
 - Combine onto single plot?

Sample Plots: Exposure

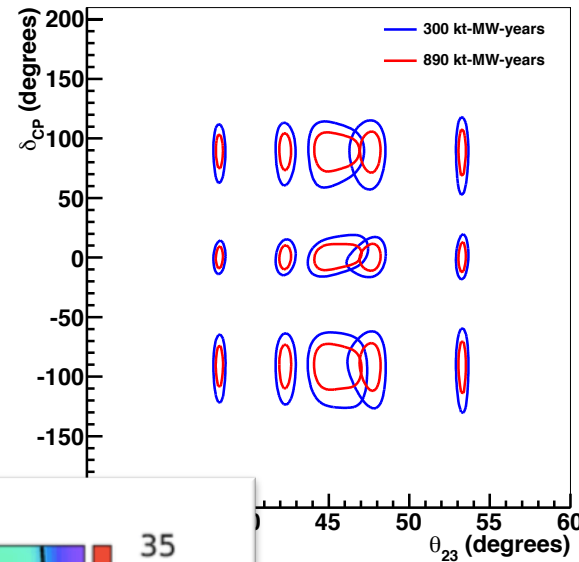


Other Plots

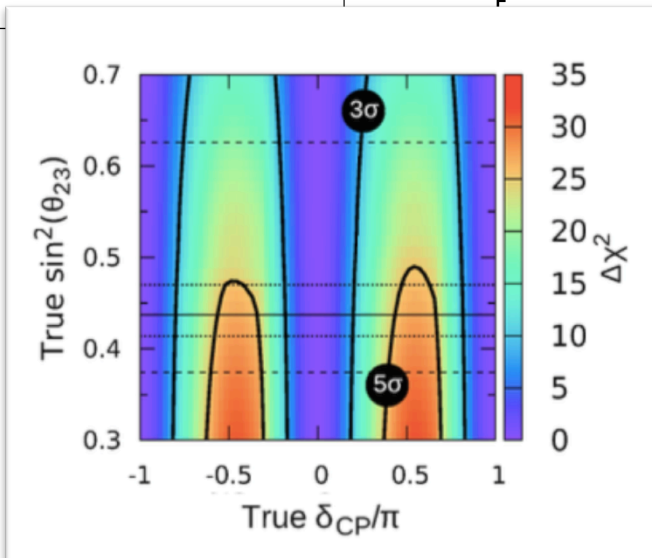
δ_{CP} vs θ_{13} :



δ_{CP} vs θ_{23} :

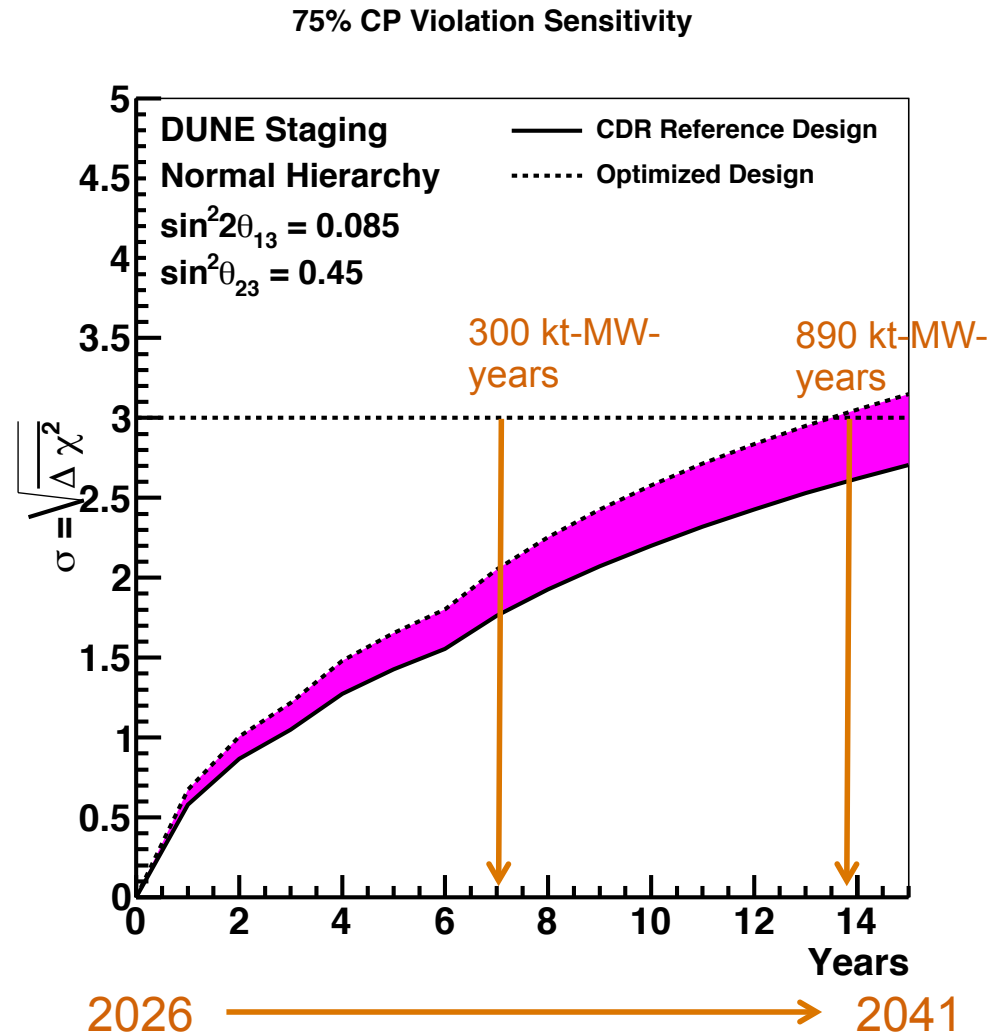


Sensitivity vs
 δ_{CP} & θ_{23} :



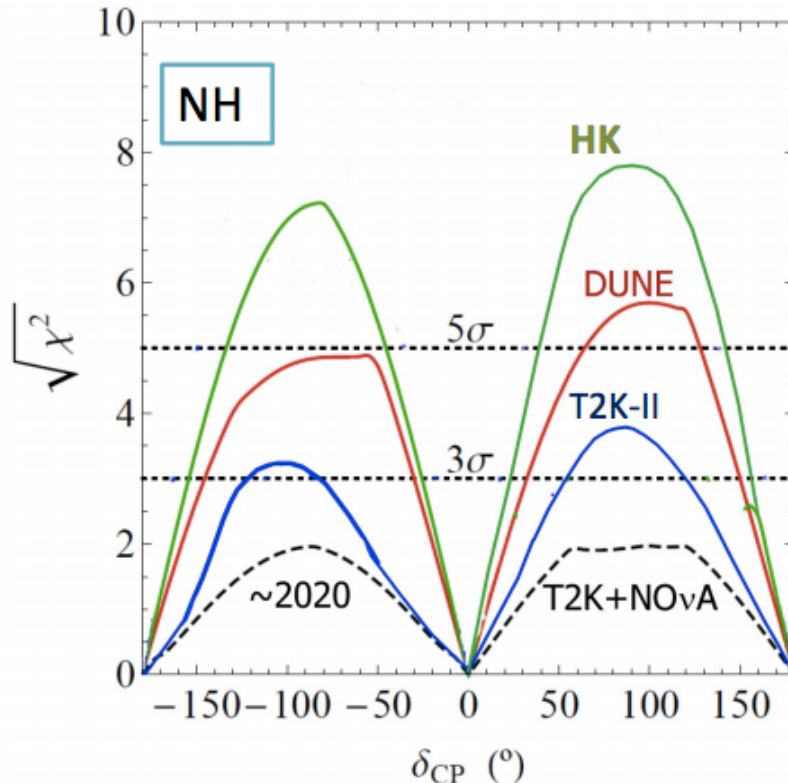
Updated Timeline

- Proposed new staging assumptions (milestones from DocDB 484):
 - Year 1 (2026): 20-kt FD with 1.07 MW (80-GeV) beam and initial ND constraints
 - Year 2 (2027): 30-kt FD
 - Year 4 (2029): 40-kt FD and improved ND constraints
 - Year 7 (2032): upgrade to 2.14 MW (80-GeV) beam (push for this)
- Note that early on this staging plan actually ramps more quickly than the CDR staging plan



Comparing experiments

M. Mezzetto, Neutrino 2016



- No one is very happy with this – including the speaker who produced it: curves digitized, assumptions don't match, controversy over whether comparison is fair...
- Far preferable to have agreed-upon comparison blessed by all experiments
- Should be coordinated at the level of the working group conveners – who is the right person to contact on each experiment?
- Possible and worthwhile?